

**UNITED STATES DISTRICT COURT  
DISTRICT OF MINNESOTA**

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Shirley K. Warren and  
Joseph W. Warren,

Plaintiffs,

v.

Bradley J. Erickson, M.D.,

Defendant.

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File No. CV-03-5593 (RHK/AJB)

**MEMORANDUM OPINION  
AND ORDER**

Roger R. Roe, Jr. and Edward P. Sheu, Best & Flanagan L.L.P., Minneapolis, Minnesota, for  
Plaintiffs.

William R. Stoeri and F. Matthew Ralph, Dorsey & Whitney L.L.P., Minneapolis,  
Minnesota; Joshua B. Murphy, of counsel at the Mayo Clinic, Rochester, Minnesota, for  
Defendant.

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**INTRODUCTION**

This matter came on for trial before the undersigned United States District Court  
Judge without a jury. Based upon the presentations of counsel, including all pre-trial and  
post-trial submissions, and all evidence submitted by the parties, the Court hereby makes  
the following Findings of Fact and Conclusions of Law.

**FINDINGS OF FACT**

In November 1999, Plaintiff Shirley Warren was referred by her primary care  
physician to the Mayo Clinic ("Mayo") in Rochester, Minnesota, for a variety of medical  
problems including headaches, hirsutism, acne, and weight gain. Warren was evaluated by  
physicians in Mayo's gynecology, endocrine, gastrointestinal, dermatology, immunology,

and neurology departments. As part of the neurology evaluation, Warren underwent magnetic resonance imaging (“MRI”) on November 9, 1999. Defendant Bradley Erickson, a neurologist at Mayo, interpreted the results of Warren’s MRI and concluded that the scan showed “a retention cyst in the floor of the right maxillary antrum. Head otherwise negative.” However, Erickson failed to observe an abnormality shown in the scan, consisting of a right thalamic arteriovenous malformation (“AVM”) in Warren’s brain.<sup>1</sup>

Less than five months later, on April 2, 2000, Warren was hospitalized at Mercy Hospital in Fort Scott, Kansas, for generalized weakness, dizziness, visual blurring, nausea, and vomiting. On April 3, 2000, testing revealed an acute intraventricular hemorrhage in Warren’s brain. Based on this diagnosis, Warren was transferred to the Kansas University Medical Center and hospitalized from April 3, 2000, until April 12, 2000. During this time, it was discovered that Warren had suffered a ruptured AVM.

As a direct result of the AVM rupture, Warren incurred significant organic brain damage. Immediately after the rupture, Warren reported to her treating physicians that she was suffering from memory difficulties, violent outbursts, and disabling headaches located in the right temporal region of her head. Neuropsychometric testing revealed cognitive dysfunction in terms of Warren’s attention, concentration, and memory.

To treat the ruptured AVM, Warren underwent stereotactic radiosurgery on May 26,

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<sup>1</sup> At trial, Dr. Myers described an AVM as follows: “an AVM is an abnormal connection between the arteries and veins in the brain without an intervening capillary bed.” (Myers Trial Tr. at 10.) Dr. Lunsford further elaborated by testifying that “an [AVM] is a net of abnormal blood vessels.” (Lunsford Trial Tr. at 12.)

2000. Radiosurgery is the application of a narrow beam of radiation in a single dose to an affected area. For a patient with a cerebral AVM, the goal of radiosurgery is to obliterate or eliminate the AVM from the patient's brain over time. The interval between the completion of radiosurgery and obliteration of an AVM is called the "latency period." The length of the latency period depends upon a variety of factors, including the location, size, and volume of the AVM.

In May 2001, one year after radiosurgery, Warren had a followup appointment at the Kansas University Medical Center, where a MRI scan demonstrated partial obliteration of her AVM. Three years after her radiosurgery, angiography documented a completely obliterated AVM in Warren's brain.

In October 2003, Warren and her husband commenced this action against Erickson alleging that his negligence in failing to diagnose the AVM on November 9, 1999, deprived Warren of treatment options that would have prevented the April 2000 rupture of her AVM. While Erickson admits that Warren's AVM was discernible on November 9, 1999, he denies that the misdiagnosis caused any injury to Warren because there was no treatment available which could have eliminated or substantially reduced Warren's chances of rupture within a five-month period — the period of time between Erickson's November 9, 1999, misdiagnosis and Warren's April 2, 2000, AVM rupture.

At trial, both parties presented witnesses on the issue of causation. Dr. Mark Myers, a Board-certified interventional neuroradiologist who specializes in vascular disorders of the brain, testified in support of the Warrens' claim. In his practice, Dr. Myers examines

and treats as many as twenty patients with AVMs annually during his rotations at seven local hospitals. Dr. Samuel Lehman, a Board-certified neurologist, also testified on behalf of the Warrens. Dr. Lehman first saw Warren as a patient on June 5, 2002, and has been treating and coordinating her care since that time. Dr. L. Dade Lunsford, a Board-certified neurosurgeon and Chair of the Department of Neurosurgery at the University of Pittsburgh, testified on behalf of Erickson. Dr. Lunsford presides over the largest radiosurgical center in the United States and has personally performed or supervised the performance of radiosurgery on the AVMs of approximately one thousand patients.

All three witnesses agreed that the average annual risk of rupture for an untreated AVM is two to four percent, and that a number of risk factors must be analyzed in order to determine whether a particular AVM is more or less likely to rupture. In terms of Warren's AVM specifically, both Dr. Myers and Dr. Lehman testified that her annual risk of rupture was within the average range of two to four percent. Dr. Lunsford, however, opined that Warren's annual risk of rupture was one percent based on the size and composition of her AVM, and the fact that she had no prior history of rupture.

In their testimony, all three doctors agreed that if Warren's AVM had been diagnosed in November 1999, she could have, and should have, undergone stereotactic radiosurgery immediately. Dr. Myers and Dr. Lehman testified that if Warren's AVM had been treated with stereotactic radiosurgery in November 1999, her AVM would not have ruptured in April 2000. Specifically, Dr. Myers opined that protection against an AVM rupture begins at the time of radiosurgery with immediate changes in the physical structure

of the AVM, and progresses gradually over time until the AVM is obliterated. He testified that in his experience, the physical structure of AVMs in his patients have changed within two to three months after radiosurgery. Dr. Lehman concurred with this observation. Even if Warren suffered a subsequent rupture, Dr. Myers and Dr. Lehman opined that stereotactic radiosurgery in November 1999 would have allowed her to survive the rupture without incurring significant or permanent brain damage.

In contrast to the foregoing opinions, Dr. Lunsford testified that even if Warren had been properly diagnosed and treated with stereotactic radiosurgery in November 1999, her risk of rupture would not have changed during the next five months. Therefore, in Dr. Lunsford's opinion, Erickson's failure to diagnose and treat Warren's AVM was not the cause of her subsequent rupture and brain damage because she would have ruptured regardless of whether she had undergone stereotactic radiosurgery in November 1999. Dr. Lunsford discussed and analyzed the opinions rendered by Dr. Myers and Dr. Lehman — that radiosurgery has an immediate impact on AVMs and lessens the probability of a rupture during the latency period — and testified that such opinions are not supported by any reliable medical studies or by his own personal experience or that of other doctors in his field. Based on his personal experience and review of the research of other doctors within the field, Dr. Lunsford testified that there is no known case in which an AVM was obliterated by radiosurgery in less than six months. Dr. Lunsford also testified that available medical data, including that relied upon by Dr. Myers and Dr. Lehman, does not support the proposition that an AVM rupture is less likely during the latency period after

radiosurgery as opposed to untreated AVMs.

### CONCLUSIONS OF LAW

To establish a claim for medical malpractice, a plaintiff must prove through the use of expert testimony: (1) the applicable standard of care, (2) that the defendant breached such standard of care, and (3) that the breach was a direct cause of injuries suffered by the plaintiff. Fabio v. Bellomo, 504 N.W.2d 758, 761 (Minn. 1993). In this case, Erickson admits the first two elements of medical malpractice — that Warren’s AVM was discernible on November 9, 1999, and that he should have investigated the condition and offered proper treatment options at that time. The Court accepts these admissions and concludes that Erickson deviated from the applicable standard of care under the facts of this case.

The only remaining legal issue for the Court to resolve is the issue of causation. To prove causation, a plaintiff must show that it was more probable than not that his or her injuries resulted from the malpractice of the defendant. Fabio, 504 N.W.2d at 762; Leubner v. Sterner, 493 N.W.2d 119, 121 (Minn. 1992); Harvey v. Fridley Med. Ctr., 315 N.W.2d 225, 227 (Minn. 1982). In this case, the parties presented three witnesses to establish causation at trial. Dr. Lunsford and Dr. Myers clearly qualify as expert witnesses on the issue of causation. Although the Court has some reservations concerning the qualifications of Dr. Lehman regarding the specific subject matter involved in this case, for the purposes of this Memorandum Opinion and Order, the Court assumes that Dr. Lehman has the necessary qualifications, background, and experience to render the opinion which he

did.

The Court concludes that the Warrens have failed to meet their burden to prove the causation element of their medical malpractice claim. Considering all of the testimony from the three expert witnesses, the Court finds that the Warrens have failed to prove that it was more probable than not that Warren's injuries resulted from the malpractice of Erickson. See Fabio, 504 N.W.2d at 762. This conclusion is founded, in large part, upon the testimony of Dr. Lunsford. After studying radiosurgery in Sweden from 1979 to 1981, Dr. Lunsford pioneered the use of radiosurgery in the United States. He is currently the chair of the Department of Neurosurgery at the University of Pittsburgh, the largest radiosurgical center in the United States. During the past eighteen years, Dr. Lunsford has performed or supervised the performance of radiosurgery on AVMs over one thousand times, and authored numerous medical publications on the subject.

During trial, Dr. Lunsford provided three opinions crucial to the causation issue in this case: (1) radiosurgery does not obliterate AVMs in less than five months; (2) during the latency period, radiosurgery does not decrease the risk of rupture as compared to the natural history of untreated AVMs; and (3) radiosurgery does not reduce the harmful consequences of AVM ruptures during the latency period. The Court finds that each of Dr. Lunsford's opinions is reliable and is based upon his own experience as well as applicable medical literature dealing with the subject matter. The Court accepts these opinions and relies on them to conclude that Warren has not established causation in this case.

The Court concludes that the opinions rendered by Dr. Myers and Dr. Lehman

concerning whether radiosurgery provides some degree of immediate protection against the rupture of an AVM are not supported by current medical data and research. Dr. Myers and Dr. Lehman testified that radiosurgery decreases the risk of rupture during the latency period as compared to the natural history of untreated AVMs.<sup>2</sup> To support this opinion, they relied in large part on a 2005 article by Dr. Maruyama, which concluded that radiosurgery decreased the risk of AVM hemorrhage during the latency period among patients who presented with a prior hemorrhage.<sup>3</sup> Dr. Myers conceded that Warren did not have a prior history of hemorrhage at the time her AVM ruptured, and that the 2005 Maruyama article did not have a statistically significant sample to determine whether a similar decreased risk occurred in patients who presented without a prior hemorrhage. (Myers Trial Tr. at 77-78.) Furthermore, Dr. Myers acknowledged that the 2005 Maruyama article does not demonstrate any reduction in the risk of AVM rupture in less than six months following radiosurgery.<sup>4</sup> (Myers Trial Tr. at 92.)

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<sup>2</sup> The testimony of Dr. Lehman was, in large part, an affirmation of the opinion rendered by Dr. Myers.

<sup>3</sup> Maruyama, et al., The Risk of Hemorrhage After Radiosurgery for Cerebral Arteriovenous Malformations, Ne. Eng. J. Med. 2005; 352:146-53.

<sup>4</sup> Q. Now, it's true, is it not, Doctor, that there is not one single article, no study of patients, that demonstrates a change in the risk of hemorrhage in the latency interval occurring in less than six months? Correct?

A. There has been no specific article addressing that timeframe. Correct.

(Myers Trial Tr. at 92:9-14.)



Dr. Myers and Dr. Lehman also relied on a 1996 study by Dr. Karlsson<sup>5</sup> to support their opinions, but there was conflicting testimony regarding the ultimate conclusion drawn in the article. On cross-examination, Dr. Myers acknowledged that the 1996 Karlsson article did not consider or examine whether radiosurgery caused any reduction in the risk of AVM rupture in less than six months.<sup>6</sup> (Myers Trial Tr. at 72-73.) Furthermore, in a subsequent article written in 2001, Dr. Karlsson reported that it is “not clear” whether the risk of hemorrhage in treated AVMs differs from the risk of hemorrhage in untreated AVMs.<sup>7</sup> (Myers Trial Tr. at 88-89.)

Dr. Myers opined that radiosurgery reduces the harmful consequences of AVM rupture during the latency period. On cross-examination, however, Dr. Myers acknowledged that this opinion has never been tested and does not reflect the belief of the medical community as a whole.<sup>8</sup> Dr. Lunsford confirmed this when he testified that the

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<sup>5</sup> Karlsson, et al., Effect of Gamma Knife Surgery on the Risk of Rupture Prior to AVM Obliteration, Minim. Invas. Neurosurg. 1996; 39:21-27.

<sup>6</sup> Q. There is no support for your position whatsoever in his article that in less than in five months there would be a change. He didn't even look at it until six months; is that right?

A. That's correct.

(Myers Trial Tr. at 72:22-73:1.)

<sup>7</sup> Karlsson, et al., Risk for Hemorrhage during the 2-Year Latency Period Following Gamma Knife Radiosurgery for Arteriovenous Malformations, Int. J. Radiation Oncology 2001; 49: 4: 1045-1051.

<sup>8</sup> Q. And then you put forth, you remember, in your deposition your theory that would intuitively suggest to you that there

“prevalent theory” is that “there is no benefit gained until the time of closure [or obliteration of the AVM] after radiosurgery.” (Lunsford Trial Tr. at 24.)

Having had the opportunity to observe Dr. Lunsford, Dr. Myers, and Dr. Lehman as they testified, coupled with the Court’s independent review of the medical literature referenced in their testimony, the Court concludes that Dr. Lunsford’s testimony is the most credible, reliable, and believable of the three, not only due to his extensive personal practice and experience with AVMs, but also his analysis of the relevant medical literature and research which was thorough and complete. Because Plaintiffs have presented

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would be a reduction in the change of hemorrhage [subsequent to radiosurgery]; right?

A. Correct.

Q. Now, you believe with radiosurgery or with embolic materials this would happen. This made sense to you in a theoretical consideration of it; is that correct?

A. That’s correct.

Q. But, as you said, you’ve done no testing that shows whether or not your theory is true; correct?

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Q. So this belief of the medical community, you would agree that there are some in the medical community that don’t agree with you that there is a decrease beginning immediately after radiosurgery in the risk of hemorrhage; correct?

A. That’s correct.

(Myers Trial Tr. at 62:6-16, 68:9-13.)

insufficient evidence to prove that it was more probable than not that Warren's injuries resulted from the misdiagnosis by Erickson, they have not established causation in this case.

### **CONCLUSION**

Based on Plaintiffs' failure to prove that Defendant's admitted breach of the applicable standard of care was a direct cause of the injuries suffered by Plaintiff, **IT IS ORDERED** that Plaintiff's Complaint (Doc. 1) is **DISMISSED WITH PREJUDICE**.

**LET JUDGMENT BE ENTERED ACCORDINGLY.**

Dated: March 7, 2006

s/Richard H. Kyle  
RICHARD H. KYLE  
United States District Judge